



Mandalay Homes

Discovery Home
Prescott, AZ



BUILDER PROFILE

Mandalay Homes
Prescott, AZ; MandalayHomes.com
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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: Discovery Home
- Location: Prescott, Arizona
- Layout: 2 bdrm, 2.5 bath, 1 fl, 2,109 ft²
- Climate: IECC 4B, mixed-dry
- Completed: May 2022
- Category: Production

Modeled Performance Data:

- HERS INDEX: without PV: 44; with PV: 14
- Annual Energy Costs: without PV: \$1,350; with PV: \$550
- Annual Energy Cost Savings: without PV: \$1,250; with PV: \$2,050
- Annual Energy Savings: without PV: 3,250 kWh; with PV: 9,590 kWh
- Savings in the First 30 Years: without PV: \$50,550; with PV: \$82,500

Mandalay Homes of Prescott capitalized on one of Arizona's most notable natural resources, the sun, to garner a Special Grand Award for Innovation in Advanced Home Concepts in the U.S. Department of Energy's annual Housing Innovation Awards competition, which recognizes exceptional builders in DOE's Zero Energy Ready Home Program.

Mandalay Homes has been offering solar panels on its homes since 2013 when the production home builder first committed to constructing all of its homes to the DOE Zero Energy Ready Home standard but several recent advances in its product offerings helped propel the builder into the limelight with DOE's first Innovation in Advanced Home Concepts grand award. "This year's 'Discovery Home' is the first to test a new energy storage algorithm we're developing in partnership with Sonnen and Mosaic Building group," said Mandalay's president and founder Dave Everson. Mandalay Homes offers 10-kW batteries on many of its homes. "We're taking a different approach to managing the battery charge and discharge throughout the day to make use of cheaper grid power when needed to ensure sufficient energy to get through the evening. The new software is also designed to help prevent demand charges by mitigating electricity usage spikes during peak periods and assuming no excess PV energy produced by the home is sold back to the utility. Our modeling has shown a 60% reduction in energy bills with the new algorithm, without excess PV energy sold back to the utility," said Everson.

In 2022, Mandalay began offering all-electric homes at the Jasper development in Prescott, Arizona. Solar photovoltaic panels are a standard part of Mandalay's iONPlus Solar home package which is available on 65% of the models sold by Mandalay. Mandalay offers an energy storage battery package on all of its solar panel-equipped homes. Although Mandalay has been offering solar and batteries for several years, this year's Discovery Home is an all-electric home with both solar



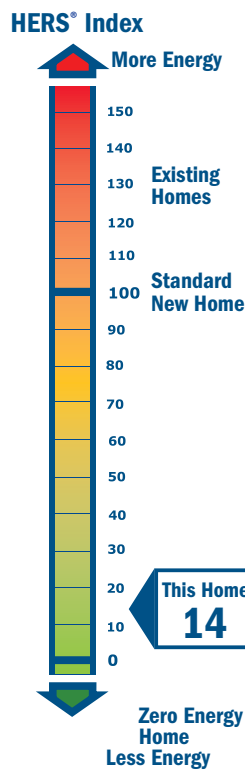
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program. Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0/3.1/3.2 for an energy-efficient home built on a solid foundation of building science research. Advanced technologies are designed in to give you superior construction, durability, and comfort; healthy indoor air; high-performance HVAC, lighting, and appliances; and solar-ready components for low or no utility bills in a quality home that will last for generations to come.

Mandalay’s award-winning home features all-LED lighting and ENERGY STAR-qualifying appliances for energy savings. To help ensure good air quality in the home, Mandalay meets all of the requirements of the EPA’s Indoor airPLUS program, including the use of low-VOC, low-formaldehyde products and finishes. Mandalay employs IAQ sensors that can trigger the ERV to operate. The home also has an in-duct ozone-free air purification system that works in conjunction with the ERV and HVAC system and uses hydrogen peroxide and high-MERV filters to capture particulates and provide anti-microbial protection, killing up to 99% of bacteria, mold, and viruses.



What makes a home a DOE ZERO ENERGY READY HOME?

- 1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0/3.1
- 2 **ENVELOPE**
meets or exceeds 2012 IECC levels
- 3 **DUCT SYSTEM**
located within the home’s thermal boundary
- 4 **WATER EFFICIENCY**
meets or exceeds the EPA WaterSense Section 3.3 specs
- 5 **LIGHTING AND APPLIANCES**
ENERGY STAR qualified
- 6 **INDOOR AIR QUALITY**
meets or exceeds the EPA Indoor airPLUS Verification Checklist
- 7 **RENEWABLE READY**
meets EPA Renewable Energy-Ready Home.



panels and the battery designed to manage the time-of-use (TOU) rate plans. With the battery storage, the home avoids the use of the higher amounts of CO₂-based power per kWh during peak periods. “We avoid dirty power and reduce the carbon footprint,” said Everson.

This home has 3.74 kW of photovoltaic panels on the roof as well as a 10-kWh, 4.8-Watt nominal battery storage system. Mandalay is taking its commitment to solar one step further by preparing its homes at Jasper to serve as a community energy source. The installation of utilities at Jasper included a dedicated network of conduit for a “virtual power plant.” This installed conduit will allow for future aggregation of power from individual homes to a central meter exiting the community. “The expectation is that one day the Jasper Community will provide stored clean peak power to the aging housing stock in the area,” said Everson.

Mandalay’s commitment to build to DOE Zero Energy Ready Home standards has had an influence beyond the approximately 400 homes a year it builds. Although Mandalay is not the only builder at Jasper, the developer has mandated that all builders at Jasper construct their homes to meet the DOE Zero Energy Ready criteria. “The success of the DOE Program and Mandalay was instrumental in this decision,” said Everson. Also, based on Mandalay’s commitment to an all-electric home, the newest phase of Jasper was built with no gas installed. Lot plans were oriented predominantly north-south for the benefit of solar panel installation. Architectural guidelines for the development specified lower roof slopes, which optimizes the angle for solar production. Mandalay also ensures adequate roof area for solar panels by eliminating penetrations through the roof with the use of side venting and air admittance valves.

A key component of the all-electric home is the mechanical system. Mandalay switched from dual-fuel equipment to an electric heat pump. The heat pump’s variable speed and pressure inverter technology helped the builder maintain high efficiency values during cold weather without the need for gas or heat strips. The cost of this new equipment was offset by eliminating the installation of gas.

Mandalay uses a building information modeling software tool to draft all of its plans and options. As each home’s options are selected, the turning on and off of layers assists the builder in creating a lot-specific plan even though it is operating in a production housing environment.



Mandalay uses a post-tensioned-slab foundation with an interesting slab-to-wall detail. The 2x6 wall bottom plates extend beyond the perimeter of the slab by 2 inches including sheathing. The slab edge is then covered with 1.5 inches of a dense, 3-pound, closed-cell spray foam that adheres to both the slab edge and the bottom edge of the overhanging bottom plate forming an air- and water-tight seal. This dense spray foam hardens to a durable surface that requires nothing more than a layer of UV paint.

“Our intention is to continue to monitor the home once it is sold to collect data on the performance, systems, and customer experience. That information will be used to shape future innovation. Our goal is to continue to improve production efficiency, decrease build times, and dramatically reduce materials waste through advanced construction management technologies,” said Everson.

Mandalay already employs several quality assurance steps. Every home design goes through an extensive review and departmental checks before being released for construction. During construction, weekly meetings are held with the superintendents, customer care staff, and the sales team. In these meetings, the progress of the home and the satisfaction level of the customers are discussed. The sales team also takes weekly photos of the home throughout the build. The photos are used to keep the homeowner updated on progress and as an additional layer of quality control. Mandalay Homes employs a comprehensive in-house quality assurance program with inspections that are performed at pre-slab, pre-drywall, post insulation, upon completion, and in the warranty process. Mandalay also uses a web-based collaborative construction management system.

In addition, DOE’s Zero Energy Ready Home program requires third-party inspections. Every ZERH certified home must meet the requirements of the ENERGY STAR Certified Homes checklists. They must be certified to the U.S. Environmental Protection Agency’s Indoor airPLUS criteria and meet the hot water distribution requirements of the EPA’s WaterSense program. DOE ZERH homes must also meet above-code insulation requirements, be blower door tested for air sealing, comply with moisture management guidelines, have ducts inside conditioned space, and use ENERGY STAR-labeled windows, lighting, and appliances. Homes should have solar electric panels installed or have the conduit and electrical panel space in place for future installation of solar panels.

This home has a Home Energy Rating System (HERS) score of 44, when the PV is not considered, or a HERS of 14 when the 3.74 kW of PV is included. The energy-efficiency measures plus the solar system should save homeowners at least \$2,000 a year in energy costs compared to a home built to code. Savings are likely greater when the battery and the impact of the utility time-of-use rates are taken into account. The 10-kW battery size is large enough to get most of Mandalay’s homeowners through the daily late afternoon energy demand peak. Mandalay has found, for most homeowners, the battery covers about 8 hours of the homes’ power needs each day

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Quality Management Guidelines

DOE Zero Energy Ready Home Program - 100% Commitment

ENERGY STAR Certified Homes Version 3.1

EPA Indoor airPLUS

National Green Building Standard

RESNET EnergySmart Builder

EPA WaterSense



Every DOE Zero Energy Ready Home combines a building science baseline specified by ENERGY STAR Certified Homes with advanced technologies and practices from DOE’s Building America research program.



Light switches incorporate motion detectors and indoor air quality sensors.

The unvented attics and vaulted ceilings are insulated on the underside of the plywood roof deck with 8 to 10 inches of open-cell spray foam for an insulation value of R-33. The roof is topped with ENERGY STAR Cool Roof certified asphalt shingles.

The exterior walls consist of 2x6 laminated strand lumber studs spaced 16 inches on center. The stud walls incorporate advanced framing techniques like three-stud insulated corners, open and insulated headers, and ladder blocking at interior wall intersections to increase the amount of space in the walls for insulation. The wall cavities are filled with open-cell spray foam in the cavities then wrapped with taped house wrap and covered with a continuous 0.5-inch-thick layer of rigid XPS foam for an R-25 total wall insulation value. The walls are covered with stucco cladding.

While the spray foam insulation in the attic and walls helps to air seal the building envelope, Mandalay takes the additional step of using a whole-house aerosolized sealant process to ensure even the smallest cracks are closed off, resulting in near Passive House airtightness levels. This home had air leakage of only 0.66 air changes per hour at 50 Pascals. An energy recovery ventilator (ERV) and timer- and moisture-controlled exhaust fans help remove contaminants from the tight home.

For heating and cooling, the home is equipped with a properly sized, two-stage, 18.2 SEER, 12.38 HSPF heat pump with a fully variable ECM motor and smart home connected user controls. The system uses 4-inch ducts installed in the sealed, conditioned attic.

A 95% efficient electric tankless water heater supplies hot water to the home. The water distribution system employs a central manifold with PEX piping and distant hot water faucets use a smart programmable recirculating pump to reduce wasted water. The piping includes an in-line water monitoring and leak detection system with automatic shutoff. All plumbing fixtures are EPA WaterSense labeled for energy and water savings. Outside the home, the builder implemented WaterSense guidelines for drought-resistant landscaping, drip irrigation, and smart irrigation.

Mandalay's home designs feature large windows and sliding doors. To keep them efficient, Mandalay uses ENERGY STAR rated, double-pane, vinyl-framed, argon-filled windows with low-emissivity coatings and an insulation value of U-0.29 (R-3.45) and a solar heat gain coefficient of 0.23.

Photos courtesy of Mandalay Homes

and some homeowners are able to run on their own stored power all night until the sun comes up the next day and the battery starts re-charging.

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KEY FEATURES

- **Walls:** 2x6, 16" o.c., R-25 total: R-25 spray foam, OSB house wrap, stucco.
- **Roof:** Truss shed roof: OSB, underlayment, asphalt shingles. 4-⁵/₈" raised heel energy trusses.
- **Attic:** Unvented attic, vaulted ceilings, 10" R-33 open-cell spray-foam on underside of roof deck.
- **Foundation:** Slab on grade, insulated slab.
- **Windows:** Double-pane, argon-filled, low-e, vinyl-framed, single-hung, U=0.29, SHGC=0.23.
- **Air Sealing:** 0.66 ACH50. Open-cell spray foam in walls and attic. Whole-house sealed with aerosolized acrylic air sealant.
- **Ventilation:** ERV to central air handler, IAQ monitors in light switches in great room, kitchen, den, bedroom, and owner's suite. Humidity sensors in light switches for exhaust fans in baths and laundry.
- **HVAC:** Central air-source heat pump, 12 HSPF, 18 SEER, 4" high-flow flex ducts.
- **Hot Water:** Electric tankless water heater, smart recirculating pump.
- **Lighting:** 100% LED, motion sensors, timers, lighting controls.
- **Appliances:** ENERGY STAR refrigerator, dishwasher, ceiling fan, exhaust fans (5).
- **Solar:** 3.74-kW rooftop panels, 10-kWh battery storage. Solar production tracking.
- **Water Conservation:** Low-flow fixtures, PEX piping, drip irrigation.
- **Energy Management System:** Smart water usage, leak detection, IAQ and RH monitors.
- **Other:** Low/No-VOC products; air purification system; energy usage monitoring. EV charging station.